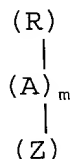


WE CLAIM:

1. A compound having the structure:



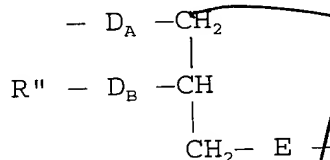
and salts thereof where:

R is R_A or R_B , where R_A is C_{1-23} alkyl or alkenyl and R_B is a steroid selected from the group consisting of stigmasterol, ergosterol and cholic acid;

m is 0 or 1, where m is 0 when Z is Z_{16} or Z_{17} and m is 1 when Z is Z_1-Z_{15} and Z_{18} ;

A is selected from any of A_1-A_3 where:

A_1 is



where D_A is bonded to R and E is bonded to Z;

R'' , independently of R, is R_A or R_B , where R_A is C_{1-23} alkyl or alkenyl and R_B is a steroid selected from the group consisting of stigmasterol, ergosterol and cholic acid;

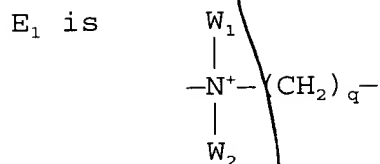
D_A and D_B , independently of one another, are selected from the group consisting of D_1-D_3 where:

D_1 is $-Y_1-CO-Y_2-$, where Y_1 and Y_2 , independently of one another, are O and NH, and wherein at least one of Y_1 and Y_2 is NH;

D_2 is $-CH=CH-O-$; and

D_3 is $-O-$ or $-CO_2-$;

E is selected from the group consisting of E₁-E₃, where

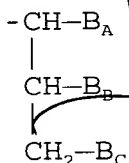


where W₁ and W₂, independently of one another, are C₁₋₂₄ alkyl, alkenyl or aryl; q is 1 to 6;

E₂ is -PO₄⁻-(CH₂)₂-NH-; and

E₃ is -(PO₄⁻)_r-[inositol]-NH-, where r is 1 or 2;

A₂ is



where B_A-B_C, independently of one another, are selected from the group consisting of the following groups B₁-B₄, wherein at least one of B_A-B_C is B₁, at least one of B_A-B_C is B₂, and at least one of B_A-B_C is B₃ or B₄, where:

B₁ is -OH;

B₂ is -NH-R, where R is C₁₋₂₃ alkyl, alkenyl or acyl;

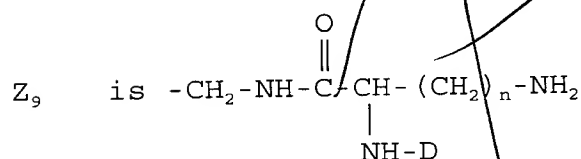
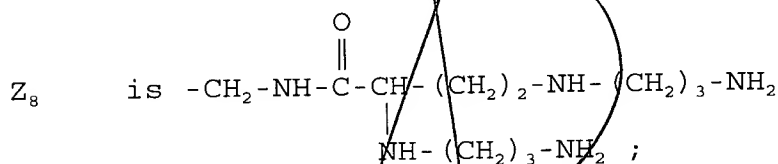
B₃ is -O-Z or -NH-Z; and

B₄ is -PO₄⁻-(CH₂)₂-NH-Z; and

A₃ is -NH-CH₂- or -CO-N-R₁-, where A is -NH-CH₂- when R is cholic acid and A is -CO-N-R₁- when R is stigmasterol or ergosterol; where R₁ is an alkyl, alkenyl, alkynyl, alkoxy, acyl or alkylthio having from 1 to about 24 carbon atoms; and

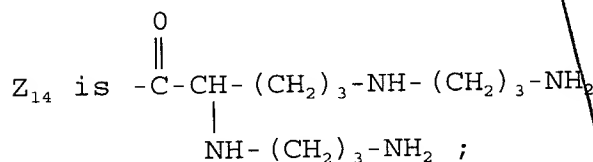
where Z is selected from the group consisting of Z_1 - Z_{15} or Z_{18} ; where:

- Z_1 is H except where W_1 and W_2 are methyl;
 Z_2 is $-(CH_2)_n-X$, where n is 1-24 and X is selected from the group consisting of Br, Cl, I and F;
 Z_3 is $-(CH_2)_n-NH_2$, n = 1-24;
 Z_4 is $-CH_2-NH-(CH_2)_3-NH-(CH_2)_4-NH_2$;
 Z_5 is $-CH_2-NH-(CH_2)_3-NH-(CH_2)_3-NH-(CH_2)_3-NH_2$;
 Z_6 is $-CH_2-NH-(CH_2)_n-NH_2$, n = 2-24;
 Z_7 is $-L-X$ where L is selected from the group consisting of branched or straight chain alkyl, alkenyl, cycloalkyl, aryl, alkoxy, thioalkyl and thioether groups having from 1 to about 24 carbon atoms, and X is selected from the group consisting of Br, Cl, I, F, NH_2 and $[(NH_2)-(CH_2)_n]_m$ where n is 2-24 and m is 1-24;



where n = 1-24, D is H or other groups attached by amide or alkyl amino groups;

- Z_{10} is a reporter molecule;
 Z_{11} is a protein, peptide or polypeptide;
 Z_{12} is a polysaccharide;
 Z_{13} is an amine or halide reactive group;



[illegible]

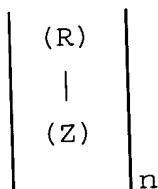
claim 5 wherein R 1

transfecting a cell with a nucleic acid and

claim 1.

- nsflecting a ce
eic acid and c

21. A compound having the repeating structure:



and salts thereof where:

n is an integer ranging from 2 to about 2,000;

R is R_A or R_B , where R_A is C_{1-23} alkyl or alkenyl and R_B is a steroid selected from the group consisting of stigmasterol, ergosterol and cholic acid; and

Z is selected from the group consisting of an amino acid and a monosaccharide.

12. A compound according to claim ⁶⁵11 where Z is a basic amino acid.

13. A compound according to claim 12 where Z is selected from the group of amino acids consisting of ornithine, lysine, arginine and histidine.

14. A compound according to claim 12 where Z is L-ornithine.

15. A compound according to claim ⁶⁵14 where Z is a sugar having from 3 to about 7 carbon atoms.

16. A compound according to claim 15 where said sugar comprises a cationic substituent.

17. A compound according to claim 16 where said cationic substituent is a tertiary amine.

18. A compound according to claim 16 where said cationic substituent is diethylaminoethyl.

19. A compound according to claim 16 where said sugar is glucose and said cationic substituent is diethylaminoethyl.

20. A composition for transfecting a cell with a nucleic acid which comprises a nucleic acid and one or more compounds according to claim 11. ⁶⁵

21. A lipid aggregate which comprises one or more compounds of claim 11. ⁶⁵

22. A method for transfecting a cell comprising the step of contacting the cell with a lipid aggregate comprising a nucleic acid and one or more compounds according to claim 11. ⁶⁵

23. A method for transfecting a cell comprising the step of contacting the cell with a lipid aggregate comprising a nucleic acid and one or more cationic lipids having the structure:

(R)

(A)_m

(Z)

and salts thereof where:

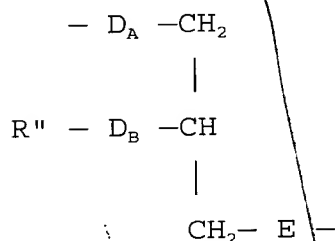
R is R_A or R_B, where R_A is C₁₋₂₃ alkyl or alkenyl and R_B is a steroid selected from the group consisting of stigmasterol, ergosterol and cholic acid;

m is 0 or 1, where m is 0 when Z is Z₁₆ or Z₁₇ and m is 1

when Z is Z_1 - Z_{15} and Z_{18} ;

A is selected from any of A_1 - A_2 where:

A_1 is



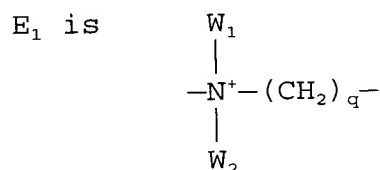
where D_A is bonded to R and E is bonded to Z;

R'' , independently of R, is R_A or R_B , where R_A is C_{1-23} alkyl or alkenyl and R_B is a steroid selected from the group consisting of stigmasterol, ergosterol and cholic acid; D_A and D_B , independently of one another, are selected from the group consisting of D_1 - D_2 where:

D_1 is $-Y_1-CO-Y_2-$, where Y_1 and Y_2 , independently of one another, are O and NH, and wherein at least one of Y_1 and Y_2 is NH; and

D_2 is $-CH=CH-O-$;

E is selected from the group consisting of E_1 - E_3 where

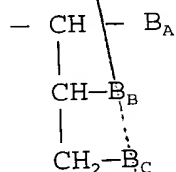


where W_1 and W_2 , independently of one another, are C_{1-24} alkyl, alkenyl or aryl; q is 1 to 6;

E₂ is $-\text{PO}_4^--(\text{CH}_2)_2-\text{NH}-$; and

E₃ is $-(\text{PO}_4^--)_r-\text{[inositol]}-\text{NH}-$, where r is 1 or 2; and

A₂ is



where B_A-B_C, independently of one another, are selected from the group consisting of the following groups B₁-B₄, wherein at least one of B_A-B_C is B₁, at least one of B_A-B_C is B₂, and at least one of B_A-B_C is B₃ or B₄, where:

B₁ is $-\text{OH}$;

B₂ is $-\text{NH}-\text{R}$, where R is C₁₋₂₃ alkyl, alkenyl or acyl;

B₃ is $-\text{O}-\text{Z}$ or $-\text{NH}-\text{Z}$; and

B₄ is $-\text{PO}_4^--(\text{CH}_2)_2-\text{NH}-\text{Z}$; and

where Z is selected from the group consisting of Z₁-Z₁₅ or Z₁₈; where:

Z₁ is H except where W₁ and W₂ are methyl;

Z₂ is $-(\text{CH}_2)_n-\text{X}$, where n is 1-24 and X is selected from the group consisting of Br, Cl, I and F;

Z₃ is $-(\text{CH}_2)_n-\text{NH}_2$, n = 1-24;

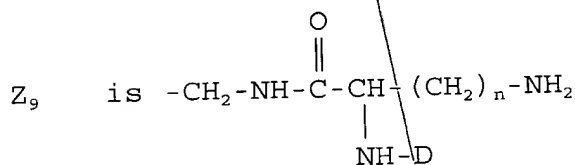
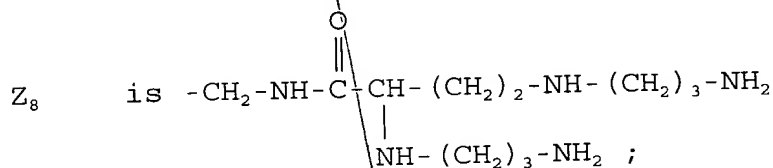
Z₄ is $-\text{CH}_2-\text{NH}-(\text{CH}_2)_3-\text{NH}-(\text{CH}_2)_4-\text{NH}_2$;

Z₅ is $-\text{CH}_2-\text{NH}-(\text{CH}_2)_3-\text{NH}-(\text{CH}_2)_3-\text{NH}-(\text{CH}_2)_3-\text{NH}_2$;

Z₆ is $-\text{CH}_2-\text{NH}-(\text{CH}_2)_n-\text{NH}_2$, n = 2-24;

Z₇ is $-\text{L}-\text{X}$ where L is selected from the group consisting of branched or straight chain alkyl,

alkenyl, cycloalkyl, aryl, alkoxy, thioalkyl and thioether groups having from 1 to about 24 carbon atoms, and X is selected from the group consisting of Br, Cl, I, F, NH₂ and [(NH₂)-(CH₂)_n]_m where n is 2-24 and m is 1-24;



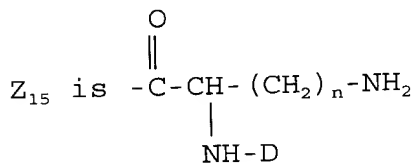
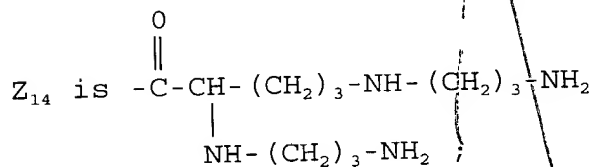
where n = 1-24, D is H or other groups attached by amide or alkyl amino groups;

Z₁₀ is a reporter molecule;

Z₁₁ is a protein, peptide or polypeptide;

Z₁₂ is a polysaccharide;

Z₁₃ is an amine or halide reactive group;



where n = 1-24, D is H or other groups attached by amide or alkyl amino groups; and

Z₁₈ is a nucleic acid binding substance.

24. The method of claim 23 wherein in the cationic lipid when A is A₂, Z is Z₁₄.

SUB
D4

25. A composition for transfecting a cell with a nucleic acid which comprises a cationic lipid of claim 1 capable of complexing said nucleic acid to be transfected into said cell, and a transfection-enhancing agent selected from the group consisting of an enveloped virus, a membrane virus, a viral component, and a non-viral fusagenic compound.

26. A composition according to claim 25 wherein said transfection-enhancing agent is an enveloped virus, and wherein said enveloped virus is an alphavirus.

27. A composition according to claim 26 wherein said alphavirus is Semliki Forest virus.

28. A composition according to claim 25 wherein said transfection-enhancing agent is a viral component and wherein said viral component is selected from the group consisting of viral proteins, envelope fusion peptides, viral spike glycoproteins, viral peptides of viral spike glycoproteins, and viral envelope fragments containing embedded viral protein.

29. A composition according to claim 25 wherein said transfection-enhancing agent is a non-viral fusagenic peptide.

30. A method for transfecting a cell comprising the steps of contacting the cell with a transfecting composition of claim 25.